Computer aided planning and information system for plant production

Prof. Dr. J. Benkő- Prof. Dr. I. Husti

SZIU, Gödöllő

Summary

In the last decades the method of production management went through a huge improvement. Nevertheless, not only the methods, but with the arrival of the computer era, the devices has also been changed. Computer aided production management integrates the planning and the production. Expenditures and costs are continuously controllable during the whole production period. The production means and materials can be used up with less costs and more security. It is an important advantage that the management gets precise and immediate information. All these facts do improve the efficiency of the production management and the operation of the company. The endeavour for improving production management has already touched the agriculture as well. However, planning software available for the agriculture are still far less than those for the industry.

1. Introduction

In the last decades the method of production management went through a huge improvement. Nevertheless, not only the methods, but with the arrival of the computer era, the devices have also been changed. Computer aided production management integrates the planning and the production. Expenditures and costs became continuously controllable during the whole production period. The production means and materials can be used up with less costs and more security. An important advantage is that the management gets immediate and precise information. All these facts do improve the efficiency of the production management and the profitability of the company.

The endeavour for improving production management has certainly touched the agriculture as well. However, planning software available for the sector is far less than for the industry. Presumably, the reason is that in Western Europe the smaller farm sizes have not required this advanced management method and consequently they have not got to sphere of interests of the leading industrial software developers yet. As to the Hungarian software developers concerned, we guess, they have not realised the changes and demands yet. Experience shows that industrial applications can hardly be adapted to the agriculture because of the characteristics of agricultural production. It seems to be more reasonable to develop special software covering the agricultural characteristics. In this presentation we have the pleasure to give an account of our development experiment in this respect.

2. Development and system expectation

The main targets of the plant cultivation management system (PCMS hereinafter) are coming from what discussed in the Introduction of this study. The management system should make a more exact cost accounting possible where expenditures influence the profitability of plant cultivation to a great extent.

Primarily: The system should ensure in field, branch, self-financing unit breakdown

the separation of operational costs (energy, material, spare parts, wages, et cetera) of the different machines (tractors, lorries, self-powered machines, working machine, etc.) and

the measurement of mechanical work in natural units (ha, t, hour, etc.) to make the costs comparable with the work;

the registration of production inputs (seeds, nutrients, insecticides, fuel, etc.) in quantity and value;

the registration of human work.

Secondly: in the knowledge of the cultivation technology and the resources (human work, machine, material), which are part of the database, the system should aid the planning, its automation and the operational management of the cultivation.

At outlining the targets and its solution you have to remember that the cultivation management system should fit into an existing accounting system including the subsystems of tangible assets and inventories. From the very first minute of the planning phase it was a necessity to ensure that the introduction of cultivation management system will not hurt the accounting system and even more, in order to avoid parallelism and multiple data recording, it has to promote the existing system with data exports.

The cultivation management system is connected with the accounting system in more points. Transactions between the two systems are the rundown on inventories and the depreciation, on one hand, at the input side of the management system and the wages and work quantities at the output side on the other. The system is modular to be ready for further development and enlargement of database.

3. The principal structure and the database of management system

Figure 1 shows the rough structure of the cultivation management system, the most important elements of which is the database. The database contains the data, which are necessary for the operation of the system, organized into data tables, the forms necessary for data input, the queries necessary for making reports and statements, the reports to be printed and the modules (program codes) suitable for different calculations [1].

The data tables of the system can be classified into three groups: base (primary) data, daily data and planning data.

Primary data are the longer-life data. They change seldom in relations with workers, machines, materials, technology, operation, land, etc. Sources of the primary data are the existing registers, documents, catalogues.

Daily data are registered from basic documents (work-sheet, waybill, stock-turnover sheet, payment order, etc.) All the information can be found in these documents in connection with the production (name of the operation done, quantity of the work, time consumed, materials and their quantities used up in the operation, who has made the operation and to whom favour, etc.). These information are all inputs and can be measured both in kind and value.

Feeding table of base data properly into the computer is the primary condition of the reliable system operation. Proper feeding means that primary documents are available and the data on them are authentic and accurate.

Output information (REPORTS AND LISTS) making possible to monitor the cultivation process and to promote the management turn up at the output side of the system as a result of several data sorting and reductions (*Figure 1*). Naturally, the headings in the frames can be enlarged. It is also possible to show the data in graphic charts.

Furthermore, an important element of the output side is the completion of the document called 'Wage accounting of the workers'. This certificate is required by the book-keeping. In principle in this point the two systems, namely the cultivation management and the accounting system, can be coupled

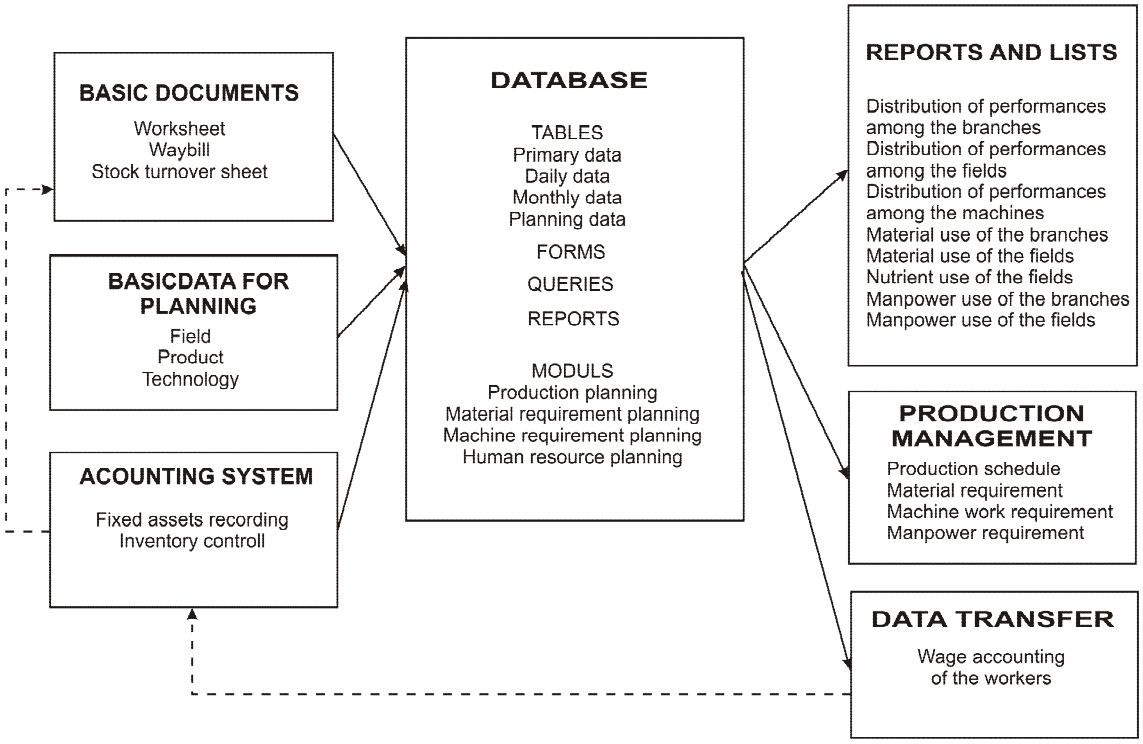

Figure 1. Scheme and operation of the management system

We took general planning requirements into consideration as well at planning the database. We use the easily understandable terminology of Microsoft Access for the description of the system. We developed the system in these surroundings. In Microsoft Access terminology an object with records and fields for storing data in a certain topic is called table. Among others (forms, queries, reports), database is composed from tables that can be linked together.

4. Operation of the planning module and its characteristics

The PCMS not only can trace the cost formation but it has unique characteristic is that the system is suitable for time-sequence planning and cost calculation of all the machine works and material demands in plant cultivation by fields and branch. This experiment can be considered as the first step on the way to approach agriculture to industry where integrated production management systems with similar tasks have been working for years. The dream can be realized that agricultural engineers, just as their mates in the industry, sitting in front of a computer screen without pen and paper can plan the forthcoming cultivation period and evaluate the available resources.

After having fed some input data (field, product, technology,) the planning module automatically makes the very time-consuming planning process. The result of the planning is a cultivation program, in chronological order, that can be broken down to branches and fields. Furthermore, the other outcome of the planning is the machine-work and material requirement, manpower and time demands for the cultivation process (*Figure 2*).

Basic data of the planning can be found in the previously introduced primary data tables, more accurately in the field, product and technology files It goes without saying that the success and the exactness of the planning depends on how authentic the content of these tables are.

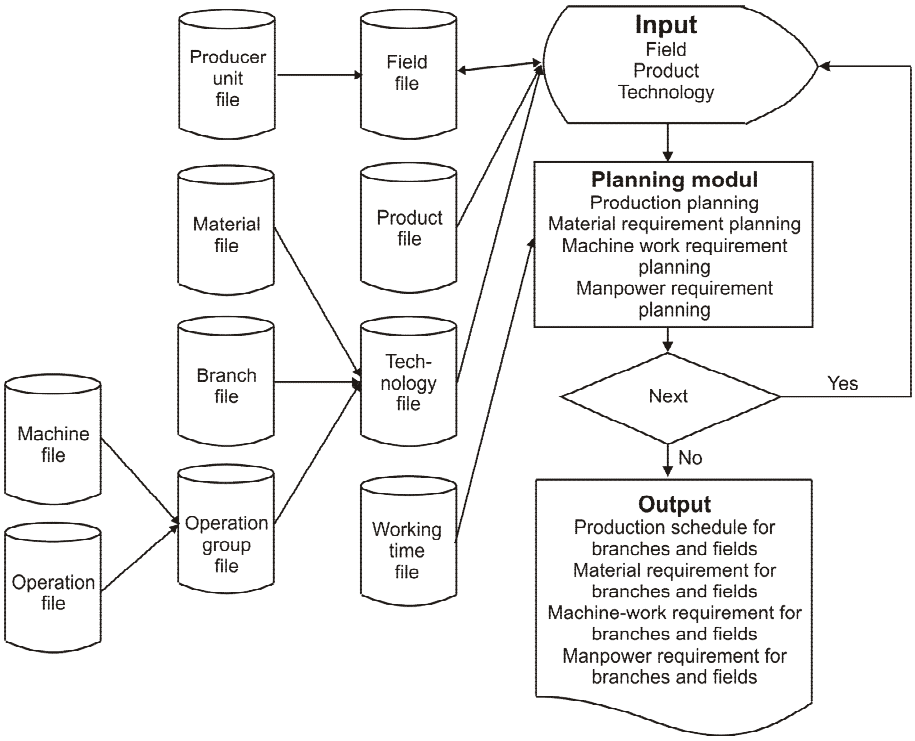

Figure 2. Scheme of the planning system

We remark that the technological description in the database has been widened by more new elements in comparison with the existing, traditional technological lists where name of the operations and its beginning and the end are listed in chronological order. The reason is that the automation of planning made it necessary that the specific demands of operations, materials and time (demand per unit area) to be added to the different operations in the technology table. At the same time the links among technology, operation group and material files provide the opportunity for calculating the costs of machine works, manpower and materials.

Planning can be realized in two phases. The steps of the first phase are: selecting the fields, providing the year of cultivation, the plant culture, the plant variety and the cultivation area. The last data is necessary because cultivation area is not always equal with the total area of the field. Parts of the field can be fallow or another reason can be that the field is divided among more plant cultures.

The second phase of the planning is the calculation of the detailed operation and material requirements. You only have to select the cultivation technology and the program will complete the planning automatically by a single command. The program computes the machine-work demand in HUF, in natural unit and in normal hectare for operations, the required materials according to technology in value and in kind again and the expected time requirement as well.

The automatically planned production schedule for the selected field is the adaptation of the range of operations fixed in the technology table. In case of demand the schedule may be modified. We can delete operations, select new operations and materials, change the specific machine-work and material demands. In the interests of speeding up the planning and making it more comfortable there is a possibility to switch on or off the elements of the operation as you please.

This production management software might become an important aid in the plant cultivation management. The advantages achievable by the application of the costs monitoring module consist of the continuous and exact monitoring of the expenditures and labour use. The

strength of the planning module, on the other hand, is that the different plan variants can be produced fairly fast with hardly any manual work saving time for the planning engineers for more sophisticated works.

5. References

[1] **BENKŐ, J.**: Növénytermelés irányítási rendszer (NIR). (MS ACCESS alatt fejlesztett termelésirányító és tervező szoftver személyi számítógépekre), Gödöllő, 2000.

[2] **HUSTI, I.**: A mezőgazdasági gépesítés ökonómiája és menedzsmentje. Mezőgazdasági Szaktudás Kiadó. Budapest, 1999.

Publikálva:

Hungarian Agricultural Engineering N° 14/2001